A GUIDE ON RADIATION SAFETY CONSIDERATIONS

IN THE PREPARATION OF RADIOACTIVE MATERIALS

LICENSE APPLICATIONS FOR INDUSTRIAL RADIOGRAPHY

Kansas Department of Health and Environment
Bureau of Air and Radiation
. Radiation Control Program
Forbes Field, Bldg. 283
Topeka, Kansas 66620
June 29, 1998

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INTRODUCTION

The purpose of this document is to provide general guidance in preparing an application for a license authorizing the use of sealed sources in radiography. Radiography as used in this guide means "the examination of the structure of materials by nondestructive methods, utilizing radiation."

The Nuclear Energy Development and Radiation Control Act of 1963 charges the Kansas State Department of Health and Environment with, among other things, responsibility for regulating the receipt, possession, and use of radioactive materials. The Department is authorized to establish by rule, regulation, or order such standards and instructions to govern the possession and use of radioactive material as it may deem necessary or desirable to protect health or to minimize danger to life or property.

In the performance of its regulatory functions, the Department has promulgated the Kansas Radiation Protection Regulations. The following parts are pertinent to the subject of this guide:

Part 1, "General."

Part 3, "Licensing of Sources of Radiation."

Part 4, "Standards for Protection Against Radiation."

Part 7, "Special Requirements for Industrial Radiographic Operations."

Part 10, "Notices, Instructions and Reports to Workers: Inspections."

These five parts are printed in the regulation book called the Kansas Radiation Protection Regulations. Current copies of these regulations may be obtained from the Kansas Department of Health and Environment, Bureau of Air and Radiation, Radiation Control Program, Forbes Field, Bldg. 283, Topeka, KS 66620.

General requirements for issuance of a specific license are contained in Regulation 28-35-180a of Part 3. Special requirements for a specific license for use of sealed sources in radiography are contained in Section 28-3 5-181 g. An application submitted in accordance with the above mentioned regulations will be evaluated against the requirements of Part 3, Part 4, Part 7, and Part 10. Part 1 contains definitions used in the other parts.

The information contained herein is intended to provide illustrative guidance and should not be considered a substitute for the applicant's careful evaluation of the proposed use of sealed sources, or for assuring that the application correctly and adequately describes the radiation safeguards and procedures to be followed.

Information not specifically discussed herein should be included with the application if the applicant considers it to be an important part of the radiation safety program. Where an application is incomplete, it may be necessary for the Department to request additional information so as to provide reasonable assurance that the applicant has established an adequate radiation safety program. Exchanges of correspondence between the Department and applicant delay final action on the application. This may be avoided by a thorough study of Department regulations and this guide prior to the filing of an application.

AS LOW AS REASONABLY ACHIEVABLE

The applicant should, in addition to complying with the requirements set forth in the Kansas Radiation Protection Regulations, make every reasonable effort to maintain radiation exposures, and radioactive material effluents to unrestricted areas, As Low As Reasonably Achievable (ALARA). Applicants should give consideration to the ALARA philosophy in the development of operating procedures and in the training of personnel using radioactive material.

Some of the items that should be considered to help maintain radiation exposures as low as reasonably achievable are discussed below. The discussion is not intended to be all inclusive, but should be used as a guide in establishing an operating philosophy for maintaining occupational radiation exposures as low as reasonably achievable.

The most important single item is the routine use of survey meters to ensure that radioactive sources have been returned to the storage container after each log operation. The necessity of performing adequate surveys should be emphasized during initial classroom training, on-the job training, and refresher training of personnel.

The habit of taking advantage of available shielding at temporary job sites also contributes to maintaining low occupational exposures. Again, this practice can and should be addressed during initial training, on-the job training, and refresher training.

In addition to the practices mentioned above, taking advantage of the full length of the handling devices, using as long a handling tool as practicable and properly storing radioactive material as soon as possible after use can all contribute to maintaining occupational exposures as low as reasonable achievable.

In addition to providing for items as those listed above, the necessity of using the safety equipment that is provided should be emphasized during initial training of radiation workers.

Management can also contribute to maintaining low occupational exposures by spreading the workload among personnel so that the same person does not always receive the assignment that involves the highest exposure. Management should review personnel monitoring records to identify those individuals who have exposures higher than the average and to try to establish and correct the cause.

FILING AN APPLICATION

The information submitted must be sufficient to allow the Department to determine that the proposed equipment, facilities, procedures, and controls are adequate to protect health and minimize danger to life and property. Information submitted should pertain to the specific activities for which authorization is sought and should be complete. Submission of incomplete information will result in delays because of the correspondence necessary to obtain supplemental information.

Applications should be mailed to:

Kansas Department of Health and Environment
Bureau of Air and Radiation
Radiation Control Program
Forbes Field, Bldg. 283
Topeka, KS 66620

State licenses are required to comply with Department rules and regulations, license conditions, and the content of the submitted application, at least one copy of all information submitted to the Department should be kept by the applicant for reference.

CONTENTS OF AN APPLICATION

The following comments apply to the indicated items of Kansas Form RH- 1:

Item la. - NAME AND MAILING ADDRESS OF APPLICANT

You the applicant, should be the corporation or other legal entity applying for the license. If you are an individual, you should be designated as the applicant only if you are acting in a private capacity and the use of the radioactive material is not connected with your employment with a corporation or other legal entity.

The address specified here should be your mailing address for correspondence. This may or may not be the same as the address at which the material will be used, as specified in Item lb.

Item lb. - LOCATIONS OF USE

You should specify all locations of storage or use by the street address, city, and state or other descriptive address (such as 5 miles east on Highway 10, Any town, Kansas). A Post Office Box address in not acceptable. Also, clearly specify whether a location is one at which radiography and associated operations will be conducted or whether the location is only for storage of sources and devices. If you will conduct radiography at temporary job sites, you may state "temporary job sites in Kansas subject to the Kansas Department of Health and Environment's regulatory authority." If radiography will be conducted in a permanent facility or facilities, you should give the specific address of each facility. Licenses will not be issued to radiographers who have no permanent facility in Kansas unless special conditions exist.

Item 2. - DEPARTMENT TO USE RADIOACTIVE MATERIAL

State the department requested, if applicable.

Item 3. - PREVIOUS LICENSE NUMBER(S)

State according to directions on application form.

Item 4. - INDIVIDUAL USERS

Indicate the personnel who will directly use or supervise the use of radioactive materials as indicated in the directions on Form RH- 1.

Radiography Personnel and Required Qualifications

A. Types of Radiography Personnel

Persons engaged in the actual handling and use of sealed sources and equipment are defined in the regulations as "Radiographer" or "Radiographer's Trainee."

A radiographer is that individual who either performs radiography himself, or who is in attendance at the site of use to personally supervise radiographic operations. The radiographer is the individual directly responsible to the licensee's management for assuring that radiography is

performed at all times in accordance with Department regulations and the conditions of the State license.

A radiographer's trainee is any individual who manipulates radiographic exposure devices, sealed sources, related handling tools, or survey instruments while under the personal supervision of the radiographer.

It is important that two points be understood: (a) the duties and responsibilities of radiographer may not be delegated to a radiographer's trainee; and (b) any individual who assists a radiographer by manipulating radiographic exposure devices, sealed sources, related handling tools, or survey instruments is acting in the capacity of a radiographer's trainee and must meet the qualifications set forth in Section 28-35-282 (b) of Part 7.

B. Qualifications of the Radiographer and the Radiographer's Trainee

Sealed sources used in radiography usually contain multi curie quantities of gamma emitting radioactive material and are hazardous if not used properly. Therefore, each radiographer and radiographer's trainee must meet certain minimum training and experience requirements. A thorough understanding of the hazards and proper procedures for safe handling and use of radiography sources is a fundamental requirement for any individual who is to assume the duties and responsibilities of a radiographer. Part 7 limits assignment of the duties of radiographer or radiographer's trainee to individuals who meet the requirements for those positions set forth in Regulation 28-35-282. In order to permit each applicant a choice in the manner of which personnel may be trained to qualify as radiographer, Regulation 28-35-282 does not specify detailed contents of a training program. Regulation 28-35-289, of Part 7, referred to in Regulation 28-35-282, itemizes those major areas in which radiographers must be instructed. Radiographers must also be instructed concerning the conditions and-provisions of the license under which they will perform radiography and must demonstrate competence to use the radiographic exposure devices, sealed sources, related handling tools, and appropriate survey instruments.

Radiographers must be supplied copies of Part 4, Part 7, and Part 10, the operating and emergency procedures, and the State license under which they operate as a radiographer.

An individual who acts as a radiographer's trainee must be instructed as to the licensee's operating and emergency procedures and must demonstrate competence to use the radiographic exposure devices, sealed sources, related handling tools, and survey instruments, which they will handle, under the personal supervision of the radiographer. Each radiographer's trainee must be supplied with a copy of the operating and emergency procedures.

Note that Regulation 28-35-282 requires radiographers and **radiographer's trainees to demonstrate** an understanding of the instructions they have received as required by that section, and to demonstrate competence to handle the equipment they will use in their assignment.

It is the licensee's responsibility to determine that a radiographer or radiographer's trainee meets the requirements set forth in the regulation.

Item 5. - RADIATION PROTECTION (SAFETY) OFFICER

Indicate the person responsible for the overall radiation safety program as indicated in the directions.

Regulation 28-3 5-181 g (4) requires submission of a description of the overall organization pertaining to the radiography program, including specific delegations of authority and responsibility for operation of the program.

Regulation 28-35-181 (d) requires that each licensee or registrant conduct an internal audit to ensure that the agency's radioactive material license conditions and the licensee's or registrant's operating and emergency procedures are followed. These audits shall be performed at least quarterly, and each radiographer shall be audited at least quarterly.

Include the following information in order to comply with the regulatory requirements:

1. A chart or description of the organization as it pertains to the radiography program specifying the name and title of each individual who has responsibility for management or supervision of the program.
2. The specific training and experience of each individual responsible for the day-to-day conduct of the program. Include the specific dates of training in radiation and radiation safety and where and by whom the training was conducted. Also, include the specifics of on-the job training, including dates, name and address of the firm, equipment used, and the date on which each individual was initially designated a radiographer.

Any individual who is responsible for the day-to-day management or supervision of the radiography program should have had a minimum of 1 year of actual experience as a radiographer.

Item 6a. - RADIOACTIVE MATERIAL

Note the radioactive materials you wish to possess for industrial radiography purposes as well as any sources you may wish to possess for instrument calibration purposes.

Item 6b. - CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM QUANTITY OF EACH CHEMICAL AND/OR PHYSICAL FORM THAT YOU WISH TO POSSESS AT ANY ONE TIME

Identify each sealed source by isotope, manufacturer, and model number. Also include the activity (quantity) of radioactive materials to be possessed at any one time for each isotope. Either a total possession limit may be used or a total limit per source may be used.

Item 7. - DESCRIBE PURPOSE FOR WHICH RADIOACTIVE MATERIAL WILL BE USED

Specify the purpose for which the licensed material will be used, e.g., industrial radiography, source exchange, or instrument calibration.

1. Identify the radiographic exposure device in which each sealed source will be used.

2. Identify any source changers by manufacturer and model number.

You should make sure that the sealed source/exposure device/source changer combinations are compatible with one another. You may designate sealed sources and source changers from more than one manufacturer if they are

compatible with the particular exposure device. This information is available from the manufacturers.

Specify the maximum amount of radioactive material that will be in each named source and the number of sources you want to possess at any one time.

Identify other sealed sources (i.e., any source that will not be used for performing radiography such as calibration sources) you may wish to possess by radioisotope, manufacturer, model number, maximum amount of radioactive material in the source, and the device, if any, in which it will be used. For example, identify a sealed source and device that will be used for instrument calibration.

Because of the large area that requires surveillance, sources that exceed 200 curies of iridium- 192 and 100 curies of cobalt-60 will not be routinely approved for temporary job site use. Sources that exceed these amounts should be used in shielded permanent facilities. If you wish to use sources in excess of 100 curies of cobalt-60 or 200 curies of iridium-192 at temporary job sites, you should provide specific information concerning where the sources will be used, the conditions of use, and how you will conduct surveillance to prevent entry into the controlled area. Your operating and emergency procedures (see Section 14.2 of this guide) should provide special instructions governing the use of such sources with particular emphasis on area surveillance.

Item 8. - TYPE OF TRAINING - Training and Experience of Individuals Named in Item 4.

Specify the types of training each individual who will utilize radioactive material has received according to subsections a, b, c, and d of the application form.

The Training Program

Except as noted in paragraph D which follows, an applicant for a radiography license must have an adequate program for the training of radiographers and radiographers' trainees. Subsection 28-35-181 (e) (1) of Part 3 by references to Regulation 28-35-282 and 28-35-289 of Part 7 lists six major categories of subjects which must be included in the training program. These categories must be separately identified and the scope of training in each category fully explained in the license application.

Initial Training

The training program must be sufficiently broad in scope to satisfy the provisions of Regulation 28-35282. Some areas referenced in 28-35-282, particularly those in 28-35-289 are sufficiently technical that an applicant may not have in its employment personnel with sufficient knowledge of radiation principles to provide instructions. In such cases, the applicant may specify that initial training will be performed by a qualified consultant or by one of the commercial companies which provide training courses for radiographers. Applicants should describe in detail the training services to be provided by the consultant or commercial concern.

An applicant must identify individuals who will conduct each phase of the training program, and fully

describe their training and experience which qualifies them to perform this service. Individuals conducting training programs should have training and experience in excess of that expected of the individuals who receive the training. Training programs should be designed to give the radiographer a practical approach to an understanding of the nature of radiation and its potential hazards. Training would normally consist of both formal instruction and some actual experience.

Training in the first three of six major categories listed in 28-35-289 is intended to give individuals working with radioactive material basic understanding of the nature of the radioactive material they will use and its' hazards. Radiographers with this 'fundamental knowledge will be better prepared to understand the reasons for the requirements of adhering exactly to **the regulations, operating** and emergency procedures, and the conditions of the applicable license.

Instruction must deal specifically with the radiation detection instrumentation, radiographic equipment, and operating emergency procedures to be used in the radiography program. If consultants or commercial courses are used, the applicant must determine that such training will cover the specific equipment and procedures used in his radiography program.

To operate safely, radiographic personnel must be thoroughly familiar with the operational features of the exposure devices they will use, so that they can safely operate the devices during normal operations and will know what to do in the event of an equipment malfunction including their diagnosis and correction. With respect to survey instruments, radiographic personnel must understand their use, limitations, how to interpret readings, and how to detect malfunctions. They should have general knowledge of radiation levels to be expected during various types of operations. Through a combination of familiarity with the exposure devices, expected radiation levels and proper use of survey instruments, malfunction of equipment can be detected and hazardous situations avoided.- For example, under normal conditions, a sealed source retracted into the exposure device and seated in its shielded position will produce certain radiation levels on the surface ofthe device. Measured radiation levels which are different from expected levels will indicate that the source may not be fully retracted or that the instrument is not functioning properly.

Periodic Training

The training program must provide updated training and instruction to radiographic personnel whenever changes in the radiography program are made. It should include such items as instruction on any applicable amendments to Department regulations; changes in equipment such as new or different radiation survey instruments, and radiographic sources and radiographic exposure devices; and revisions to the operating and emergency procedures. The licensee must determine that radiographers and radiographer's trainees have an understanding of these changes and are competent to use newly added instruments and radiation equipment. Refresher instructions on the fundamentals of radiation protection should be given periodically. The applicant should describe the periodic training portion of his program.

On-the-Job Training

On-thejob training should provide personnel with necessary competency in the handling and use of radiographic exposure devices, sealed sources, related handling tools and survey instruments. Sufficient time must be assigned for on-thejob training to assure that personnel will be competent to handle all equipment involved in the program and to enable the licensee to determine that personnel are competent.

The last two items to be described in the application regarding the training program are procedures to be

followed to determine that radiographic personnel understand the instructions which they have received and are competent to handle and use the equipment which will be involved in the radiography program. The applicant must keep in mind that it is his responsibility to assure that licensed radioactive material will be safely used. Procedures for determining qualifications should consist of comprehensive written and oral examinations covering the instructions which have been provided personnel and personal observation of the trainee's actual handling and use of the equipment. The applicant should submit copies of a typical examination, or describe the scope of the examination and provide samples of the types of questions asked and the answers which are considered acceptable. A standard unchanging or a simple true-false type of examination should not be used for obvious reasons.

In describing how personnel will demonstrate their ability to use the equipment, the applicant should describe the handling procedures which will be required of the trainee, and what points the observer will specifically check to establish the trainee's ability to safely use the particular equipment. This procedure of observation should show that the trainee can safely operate the exposure devices to be used, proper use of survey instruments, and correctly interpret the survey instrument's readings. The observer should determine that the individual understands the requirements contained in the Department's regulations and the operating and emergency procedures of the applicant. The licensee must maintain appropriate records to show that his personnel engaged in radiography have satisfactorily completed the training program in his application.

Item 9. - EXPERIENCE WITH RADIATION (ACTUAL USE OF RADIOISOTOPES OR EQUIVALENT EXPERIENCE)

This section should be filled out to indicate the experience of all personnel directly using or supervising the use of radioactive materials. Information supplied should include when material was used, for what time periods, types of isotopes used, strength of isotopes, etc.

Items 10. and 11. - RADIATION DETECTION INSTRUMENTS AND METHOD. FREQUENCY AND STANDARDS USED IN CALIBRATING INSTRUMENTS

Regulation 28-35-278 requires that a licensee maintain sufficient calibrated and operable survey meters to make physical radiation surveys as required by Parts 4 and 7, that the instruments have a range sufficient to measure 2 milliroentgens per hour through 1 roentgen per hour, and that the instruments be calibrated at intervals not to exceed 3 months and after each instrument repair.

State that you will have operable and calibrated survey meters with a range from 2 milliroentgens per hour through 1 roentgen per hour. Include a statement that the meters will (1) be calibrated so that the readings are plus or minus 20% of the actual values of the range of the instrument, (2) have a calibration chart or graph showing the results of the calibration, the date of the last calibration, and the due date of the next calibration affixed to the survey meter, and (3) be calibrated at least every 3 months or after each servicing. Also state that calibration records will be kept for a minimum of two years after each calibration and identify by whom the instruments will be calibrated. If calibration is performed by a person or firm outside your organization, identify each person or firm by name and/or Agreement State/NRC license number.

Regulation 28-35-284 (c) states that pocket dosimeters must be verified yearly. The results of these tests must be such that the dosimeters are within plus or minus 30% of the indicated responses. This is only a method which allows you to determine if the dosimeters function properly. Records should be kept indicating that these yearly checks have taken place.

For detailed information about survey instrument calibration, refer to ANSI N323-1978, "Radiation Protection Instrumentation Test and Calibration."

Item 12. - FILM BADGES. DOSIMETERS' AND BIOASSAY PROCEDURES USED

Regulation 28-35-284 of Part 7 requires that radiographers and radiographer trainees wear directreading pocket dosimeters and either film badges or thermoluminescent dosimiters (TLDs) during radiographic operations. The pocket dosimeters must have a range greater than 200 milliroentgens is acceptable only if more than one dosimeter is worn and at least one of the dosimeters has a range of 0 to 200 milliroentgens.

The only information needed in your application is a statement that the required personnel monitoring equipment, including 0- to 200 milliroentgen dosimeters, will be used by radiographic personnel. State your maximum time period for exchange of the film badges or TLDs. The maximum time recommended for the exchange is monthly for film badges and TLDs.

Item 13. - FACILITIES AND EQUIPMENT

Regulation 28-35-180a states that an application will be approved if, among other things, the applicant's proposed equipment and facilities are adequate to protect health and minimize danger to life or property.

A permanent radiographic installation is at a fixed location, is shielded so that the area outside the facility is an unrestricted area, and is not under continuous surveillance. The facility may be used only occasionally for performance of radiography, but it should be considered a permanent facility because it is the nature of the facility rather than the frequency of use that determines whether the facility is a permanent radiographic facility.

If you intend to perform radiography in a permanent radiography facility or facilities, provide the following information for each facility:

1. An annotated sketch or drawing of the facility and its surroundings that shows:

    a. The scale to which the sketch or drawing is made (the same scale should be used for all sketches and drawings).

    b. The type, thickness, and density of shielding materials on all sides, including the floor and roof.

    c. The locations of entranceways and other points of access into the facility.

    d. A description of the nature of the areas adjacent to the facility and the distance to these areas. Include information on areas adjacent to, above, and below the facility.

2. A description of the visible-audible signal system, its location, and how it meets the requirements in 28-35-288(d). The visible signal must be activated by radiation whenever the source is exposed, and the audible signal must be activated when an attempt is made to enter the facility when the source is exposed. The requirement for the visible-audible signal system is in addition to such other measures that may be taken to prevent access into the facility as locked doors.

Regulation 28-35-220a provides an alternative to the visible-audible alarm system required by 28-35288(d). It is acceptable to use a system that will reduce the radiation level if the entrance to a high radiation area is opened while a source is out of its safe storage condition. The system must be automatic and may not depend on action by radiography personnel. If you intend to use this alternative, provide a description of your system.

3. The results of radiation level calculations or actual radiation measurements adjacent to, above,and below the facility. The radiation level in all directions around the facility, including the roof, should not exceed 2 milliroentgens in any hour. Clearly identify the type of source (isotope), the amount of radioactive material in the source, and the position ofthe source withinthe facility for the calculations or measurements.

Variances will be considered if construction requirements preclude shielding the roof to meet the 2milliroentgen in any hour radiation level. Provide the following information to obtain approval for a variance:

a. Means of access to the roof.

b. Procedures for ensuring that no individual is on the roof or could gain access to the roof during the performance of radiography.

c. A commitment that the roof will be posted with "Caution (or Danger) Radiation Area" signs.

d. The steps taken to minimize radiation on the roof.

Radiation levels in excess of a high radiation area (100 mrem in any hour whole body exposure) require special access controls (see 28-35-220a).

4. Limitations (if needed) on positioning or sources or type (isotope) and amount of radioactive material that may used in the facility to ensure that areas adjacent to, above, and below the facility will be uncontrolled areas during the performance of radiography.

Item 14. - RADIATION PROTECTION PROGRAM

14.1 The Internal Inspection System or Other Management Control

An applicant for a radiography license must have an established system for maintaining active control over receipt, possession and use of radioactive material procured under the license. The system must assure that the license provisions, Department regulations, and operating and emergency procedures are followed by radiographers and radiographer's trainees. Subsection 28-35-181g (3) of Part 3 requires that the applicant for a radiography license include with his application a description of the internal inspection system or other management control to be followed for maintaining such active control.

The type and extent of the radiography program to be conducted will establish the frequency and scope of the system to be followed. Periodic inspections of radiographic operations should be made by a person of authority in management on both an announced and unannounced basis. Management should exercise a continued review of records or receipt and disposal of licensed material, and such records as personnel monitoring results, instrument calibrations, leak test results, quarterly inventories, utilization logs, and surveys. The Department will review adequacy of the system to be followed by the applicant against the proposed radiography program as described in the application.

14.2 Operating and Emergency Procedures

Regulation 28-35-181g requires that operating and emergency procedures be established and submitted to the Radiation Control Program, as part of your application. In addition, if radiographers will perform

other operations such as source exchange, leak-testing, and quarterly inspection and maintenance of equipment, appropriate procedures and instructions for these operations should be included in your operating and emergency procedures.

The purpose of operating and emergency procedures is to provide radiography personnel with clear and specific guidance and instruction for all operations they will perform. The topics that should be included in the operating and emergency procedures are not in any specific order of importance. A sequential set of procedures and instructions from the beginning to the end of the workday is an acceptable format. Instructions for nonroutine operations, for example, quarterly inspection and maintenance, may be included as appendices.

Regulation 28-35-283 lists the topics that need to be covered in your operating and emergency procedures.

14.2.1 Handling and Use of Sealed Sources and Radiography Exposure Devices

Provide step-by-step instructions for using each type of radiographic device. Instructions for "crankout" devices should be separate from those for "pipelines" devices. Manufacturers' manuals and similar documents should not be incorporated into the procedures; rather, information should be extracted from them.

14.2.2 Methods and Occasions for Conducting Radiation Surveys

The following are examples of surveys you will need to make during radiography and associated operations:

a. Determining the boundary of the controlled area.
b. Determining that the source has returned to the safe storage position after each radiographic exposure.
c. Determining the radiation levels at external surfaces of storage facilities, including vehicle used for storage.
d. Determining the radiation levels in and around vehicles used for transporting sources devices.
e. Determining that radiation levels around containers prepared for shipment comply with Department of Transportation regulations.
f. Determining the radiation levels in and around vehicles used for transporting sources and devices.
g. Determining that radiation levels around containers prepared for shipment comply with Department of Transportation regulations.
h. Determining that radiation levels around radiographic exposure devices comply with the requirements in 28-35-275.
i. Determining that sources are in a safe storage position following source exchange and that radiation levels around source changers meet regulatory requirements.

These surveys will be discussed in more detail under the appropriate topics. In general, surveys needto be made whenever a source is manipulated or moved.

14.2.3 Methods for Controlling Access to Radiographic Areas

Regulation 28-35-219(a) of Part 4 requires posting of radiation areas and high radiation areas, respectively.

For temporary job site radiography, it is acceptable to post the perimeter of the controlled area rather than the perimeter of the radiation area. Instruct personnel to post "Caution (or Danger) Radiation Area" signs at the calculated 2 milliroentgens in any one hour radiation level and to make a confirming survey after the source has been exposed.

The perimeter of the high radiation area must be posted with "Caution (or Danger) High Radiation Area" signs at the calculated 100 milliroentgens per hour radiation level. Do not include instructions for a confirming survey of the high radiation area perimeter, since such a survey could lead to unnecessary exposure of personnel.

For permanent radiographic installations, provide instructions to personnel about posting the enhance to the facility with "Caution (or Danger) High Radiation Area" signs and provide procedures to ensure that the visible-audible signal system is operable.

Regulation 28-35-285 requires direct surveillance to protect against unauthorized envy into a high radiation area except where the high radiation area is equipped with a control device or alarm system or where the high radiation area is locked to protect against unauthorized or accidental enky.

For radiography in nonpermanent facilities, instruct personnel to keep the perimeter of the controlled area under continuous surveillance. Specify steps to take in the event that unauthorized personnel enter the controlled area, for example, immediate termination of the radiographic exposure. Surveillance of the perimeter of the controlled area will protect against entry into the high radiation area and prevent unnecessary exposure of individuals.

14.2.4 Methods and Occasions for Locking and Securing Radiographic Exposure Devices, Storage Containers, and Sealed Sources

Regulation 28-35-276 requires that locked radiographic exposure devices and storage containers be physically secured to prevent tampering or removal by unauthorized personnel. Unless a radiographer or radiographer's trainee is physically present to maintain surveillance, a device containing a source should be placed in storage so that it is not accessible to unauthorized persons.

There may be situations in which radiography is performed in such a location that it would take extraordinary effort to gain access to the device, e.g., at the top of a building under construction. In anticipation of such situations, provide specific procedures for an alternative method of securing the device and the circumstances for the alternative method. Keep in mind that roping an area and posting signs do not constitute an acceptable alternative.

The storage facility should be such that the area around it is an uncontrolled area (no more than 2 milliroentgens in any hour at 12 inches (30 cm) from any surface); the facility should be posted with "Caution (or Danger) Radioactive Material" signs. A physical survey should be performed to confirm that the area around the storage facility is an uncontrolled area.

Regulation 28-35-276 requires that devices be secured in the shielded position each time the source is returned to that position. The procedures for using the devices must require locking the device at the end of each exposure. A radiation survey must be performed to confirm that the source is in the safe shielded position. For crankout devices, the survey must include the guide tube and the device itself.

14.2.5 Personnel Monitoring and the Use of Personnel Monitoring Equipment

Regulation 28-35-284 states that no individual may act as a radiographer or radiographer's trainee unless, at all times during radiographic operations, that persons wears a direct-reading pocket dosimeter and either a film badge or thermoluminescent dosimeter (TLD). Personnel should be instructed that they are required to wear direct-reading pocket dosimeters and film badges or TLDs when they are engaged in radiographic operations. Personnel should be instructed to charge their pocket dosimeters at the start of each workday so that the dosimeters are capable of reading full scale.

The dosimeter reading must be recorded at the beginning and end of each workday.

Include instructions about how and where dosimetry devices are to be stored when not in use. The storage place should be dry, radiation free, and cool so that the devices will not be affected by adverse environmental conditions.

14.2.6 Transporting Sealed Sources to Field Locations, Securing Exposure Devices and Storage Containers in Vehicles, Posting of Vehicles, and Control of Sealed Sources During Transportation

Regulation 28-35-195a and 28-35-196a of Part 3 requires that transport of licensed material be carried out in accordance with the applicable requirements of the Department of Transportation. Consult the Department of Transportation's (DOT's) regulations for detailed information about transportation requirements. Instructions to personnel should not reference DOT requirements. Information should be extracted and placed into the instructions so that personnel know exactly what they are expected to do. The following items should be covered in instructions to personnel:

1. Labeling containers with the appropriate label as specified in Sec.172.403 of 49 CFR Part 172of the DOT's regulations, i.e., instruction on how to determine which label (Radioactive White I, Radioactive Yellow II, or Radioactive Yellow III) must be used.

2. Securing the exposure device or storage container within the transporting vehicle. The instructions should specify how the package is to be secured in the vehicle so that it cannot move during transport.

3. Placarding both sides, the front, and the back of the vehicle with "Radioactive" placards if the package being transported requires a Radioactive Yellow III label. Sections 172.519 of 49 CFR Part 172 of the DOT's regulations contain the specifications for the placards.

4. Surveying the exterior surfaces and passenger compartment of the vehicle to ensure that the radiation levels do not exceed 2 milliroentgens per hour at 18 inches (45 cm) from any exterior surface and 2 milliroentgens per hour in the passenger compartment. Include instructions to personnel on the measures that should be taken if the radiation level exceeds 2 milliroentgens per hour in the passenger compartment. For example, instruct them to add more shielding or reposition the device within the vehicle.

A vehicle used for transport could also be used for storage at a temporary job site. If the vehicle will be used for storage, there should be instructions to personnel about proper posting ofthe vehicle. The RADIOACTIVE placards that would be on the vehicle if a package with Radioactive Yellow III label were transported should be removed and "Caution - Radioactive Material" signs should be substituted. The radiation level may not exceed 2 milliroentgens per hour at 18 inches (45 cm) from any external surface of the vehicle. The vehicle should, of course be locked when it is used for storage.

14.2.7 Minimizing Exposure of Persons in the Event of an Accident--Emergency Procedures

An emergency situation is considered to exist whenever an abnormal event occurs, e.g., failure of a source to return to the safe storage position. Since it is not possible to list or specify all possible situations that would constitute an emergency, a general instruction is acceptable.

Radiography personnel should not attempt to perform operations involving retrieval or recovery of a source not in the shielded position unless they have had specific instruction and actual practice in retrieval operations with a dummy source. If you intend that radiographic personnel perform source retrieval or recovery, include in your Raining program a description of the instruction they will receive, including practice with a dummy source. In addition, include specific instructions for source retrieval in your operating and emergency procedures.

Unless personnel have had instruction and Paining in source retrieval or recovery, include the following instructions to personnel:

1. Establish and post the controlled area at the 2 milliroentgens per hour radiation level.

2. Maintain continuous surveillance of the controlled area until the situation is corrected.

3. Notify management or other appropriate persons.

In addition, describe the action to be taken by management.

14.2.8 Notification of Proper Persons in the Event of an Accident

In the emergency procedures, clearly identify the names and telephone numbers of management or supervisory personnel to be notified in the event of an accident. The **individuals to be notified should** be those persons who are in a position to take appropriate action in an emergency or accident. Such persons could also include those in police and fire departments, depending on **the emergency or the** Bureau of Environmental Health Services, Radiation Control Program.

14.2.9 Maintenance of Records

When you are granted a license, you must generate and maintain certain records. Among these are records generated by radiography personnel during the performance of radiography, including:

1. Utilization logs as required by 28-35-281. The instructions to personnel should clearly specify the need for the utilization log. The elements required are:

   a. The make and model number of the device used.
   b. Identification of the radiographer.
   c. Where the device is used and the date.

2. Records of daily inspection of equipment as required by Regulation 28-35-287. Instructions to personnel should specify that a record be made of the daily inspection.

3. Pocket dosimeter readings as required by 28-35-284. These readings should be made at the

beginning and end of a work shift. Instructions to personnel must specify that the readings berecorded.

4. Instructions to personnel should specify that a record of the final survey be made. Results of the physical survey following the final exposure of the day or operation as required by 28-35-287.

There may be other operations performed by radiography personnel for which records should be generated. These operations may include quarterly inspection and maintenance, instrument calibration, shipment of packages, etc.. If management requires radiographers to perform operations associated with the performance of radiography, the instructions dealing with these operations should include instruction for an appropriate record of the performance of the operation.

14.2.10 Daily Inspection and Maintenance of Exposure Devices and Storage Containers

Regulation 28-35-287 requires that radiographic exposure devices, storage containers, and source changers be checked for obvious defects prior to use each day the equipment is used.

The instructions to personnel must clearly reflect the regulatory requirement that the daily inspection be performed each day before the equipment is used. If equipment is used on more than one shift during a day, the equipment should be checked at the start of each shift.

Specify in the instructions to personnel the items that must be checked and the steps to be taken if any defects are found in the equipment. Manufacturers of the equipment can provide a list of items that should be checked in the daily inspection. A record of the performance of the daily inspection should be made.

Exhibit 2 provides examples of instructions for daily inspection of radiographic devices. Your instructions should be tailored to your program and to the devices you wish to possess and use.

14.2.11 Off-Scale Pocket Dosimeter Readings

Regulation 28-35-284 requires that an individual's film badge or TLD be immediately sent for processing if the self-reading pocket dosimeter is found to be off scale. There are no exceptions to this requirement. Regardless of the circumstances, the film badge or TLD must be sent for processing if the pocket dosimeter is found to be off scale during or at the end of the work shift of the person who was wearing the dosimeter.

Instructions to personnel for action to be taken if a dosimeter is found to be off scale should, as a minimum, include the following:

1. Stop work immediately and place the source in the safe storage position in the exposure device.

2. Notify the individual specified in the emergency procedures.

3. Do not return to work until results are received.

14.2.12 Procedure for Identifying and Reporting Defects and Noncompliance

If radiography personnel discover any malfunction or defect in radiography equipment, management should be notified so that it can take appropriate action. Instructions to personnel should require management notification if equipment malfunctions or defects are found.

14.2.13 Other Tasks

As indicated earlier in this guide, radiography personnel may be assigned responsibility for carrying out other operations such as source exchange, quarterly inspection and maintenance of equipment, and leak-testing. If radiography personnel are assigned such tasks, specific instructions for performance of the tasks should be included in the operating and emergency procedures.

14.3 Leak-Testing

Regulation 28-35-279 contains the requirements for leak-testing sealed sources. The options for leak testing are:

1. Engage the services of a consultant or commercial facility to take samples, evaluate the samples, and report the results to you.

2. Use a commercial leak-test kit. You take the smear and sent the smear to the kit supplier, who reports the results to you.

3. You perform the entire leak-test sequence, including taking the smears and measurement.

For Option 1, specify the name, address, and license number of the consultant or commercial organization.

For Option 2, specify the kit model number and the name, address, and license number of the kit supplier. If the sample will be taken by individuals in your organization who have management or supervisory responsibilities, the names of the individuals should be specified. If radiographers will take the test sample, include instructions for taking the sample in your operating and emergency procedures. Include in the instructions a requirement that any indication of possible source leakage should be reported to management for appropriate action.

For Option 3, specify how and by whom the test sample will be taken, the instrumentation that will be used for measurement, and the individual who will make the measurement and his or her qualifications. An instrument capable of making quantitative measures should be used. Hand-held survey meters will not normally be considered adequate for measurements. A sample calculation for conversion of the measurement data to microcuries should be included.

Item 15. - WASTE MANAGEMENT

The disposal of licensed material must satisfy the general requirements stated in Part 4. Regulation 28-3 5-223a requires the licensed material contained in radiographic devices be disposed of by transfer to an authorized recipient. Authorized recipients are the original supplier, a commercial firm licensed by the NRC or an Agreement State to accept radioactive waste from other persons, or another specific licensee authorized to possess the licensed material. Specify how you will dispose of licensed material.

Item 16. - CERTIFICATE

Your application should be dated and signed by a representative ofthe corporation or legal entity who is authorized to sign official documents and to certify that the application contains information that is true and correct to the best of your knowledge and belief. Unsigned applications will be returned for proper signature.

AMENDMENTS TO A LICENSE

After you are issued a license, you must conduct your program in accordance with (1) the statements, representations, and procedures contained in your application, (2) the terms and conditions of the license, and (3) the Kansas Radiation Protection Regulations.

It is your obligation to keep your license current. You should anticipate the need for a license amendment insofar as possible. If any of the information provided in your application is to be modified or changed, submit an application for license amendment. In the meantime, you must comply with the terms and conditions of the license until it is actually amended; you may not implement changes on the basis of a submission requesting an amendment to your license.

Examples ofthe more common amendments to licenses for industrial radiography include:

1. Addition of a new source/exposure device/source changer combination.

2. Change in your organizational structure, e.g., persons responsible for the conduct of the radiography program.

3. Addition of a new location of use or storage.

For example, if you wish to add a new source/device/source changer combination, you should review your operating and emergency procedures to ensure that changes are made to accommodate the new equipment, including instruction for use and daily inspection. Quarterly inspection and maintenance and leak-testing need to be considered.

Similarly, in your application for a license amendment, you should consider the impact that the change will have on other documents. Any necessary modification of documents or procedures should be submitted so that additional correspondence will not be necessary.

An application for a license amendment may be submitted either on the application form (Kansas Form RH-I) or in letter form (in duplicate) and sent to the address specified on the front of this guide. Your application or letter should identify your license by number and should clearly describe the exact nature of the changes, additions, or deletions. You should make clear and specific references to previously submitted information and documents, and you should identify the pertinent information by date, page, and paragraph. For example, if you wish to make a change in the individual responsible for your radiation safety program, your application for a license amendment should not only specify the name of the new individual but also include his or her training and experience. Moreover, the qualifications for the new individual should be equivalent to those specified in Item 7 of this regulatory guide.

RENEWAL OF A LICENSE

Licenses are issued for a period of up to 2 years. You should send an application for renewal to the address specified in this guide. You may submit an entirely new application for renewal as if it were an application for a new license without referring to previously submitted information.

As an alternative, you may:

1. Review your current license to determine whether the information concerning your sealed sources, radiographic devices, etc., accurately represents your current and anticipated program. Identify any additions, deletions, or other changes and then prepare information appropriate for the required changes.

2. Review the documents you have submitted in the past to determine whether the information in them is up to date and accurately represents your facilities, equipment, personnel, radiation safety procedures, locations of use, and so on. The documents you consider to represent your current program should be identified by date. Any out-of-date or superseded documents should also be identified, and changes~should be made in the documents, as necessary, to reflect your current program.

3. Review Kansas' current regulations to ensure that any changes in the regulations are appropriately covered in your program description.

4. After you have completed your review, submit a letter to the Radiation Control Program requesting renewal of your license and providing the information specified in Items I, 2, and 3, as necessary.

5. Include the name and telephone number of the person who may be contacted about your renewal application and include your current mailing address if it is not stated correctly on your license.

If your application for license renewal is filed at least 30 days before the expiration date ofthe license, your license will automatically remain in effect until the Radiation Control Program take final action on the application. However, if your~application is filed less than 30 days before the expiration date and the Radiation Control Program cannot process it before that date, you would be without a valid license when your license expires.

If you do not wish to renew your license, you must dispose of all licensed radioactive material you possess in a manner authorized by Part 4. Complete Form RH-13 "Request to Terminate Kansas Radioactive Materials License" and return it before the expiration date of your license with a request that your license be terminated. If all the licensed radioactive material in your possession cannot be disposed of before the expiration date, a license renewal should be requested for storage only of the radioactive material in order to avoid violating the requirement that you may not possess licensable material without a valid license.

EXHIBIT 1

Field Radiography

Internal Inspection Checklist

Radiographic Location_____Date_____Time_____

Radiographer_____Inspector_____

Radioisotope_____ Curies_____Serial No._____

Projector Serial No._____ Projector Model No._____

Survey Meter Model No._____Serial No._____Calibration Due Date_____

1. Was the radiographer wearing a film badge and dosimeter?
2. Were other individuals working within the controlled area wearing film badges and dosimeters?
3. Was the controlled area posted with "CAUTION (or DANGER) HIGH RADIATION AREA" signs?
4. Was the controlled area properly controlled to prevent unauthorized entry?
5. Was the high radiation area posted with "CAUTION (or DANGER) HIGH RADIATION AREA" signs?
6. Did the radiographer have a calibrated and properly operating survey meter?
7. Was the utilization log properly filled out?
8. Did the radiographer have sufficient knowledge of safety rules? (Ascertained by oral questions)
9. Was the radiographer working with defective equipment?
10. Did the radiographer properly survey the source projector and source tube and take a radiation reading l foot (0.3 m) in front of the source following the radiographic exposure?
11. Were radioactive isotopes stored properly and kept locked to prevent unauthorized removal?
12. Was the storage area posted with "CAUTION (or DANGER) RADIOACTIVE MATERIAL" signs?
13. Did the radiographer possess a copy of the applicant's operating and emergency procedures and the Kansas Radiation Protection Regulations?

14. Were there any items of noncompliance other than those listed on this form? (If any, explain in remarks.)

Remarks

_____

_____

_____

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EXHIBIT 2

Daily Maintenance Check of Radiographic Device

The radiographer will perform a daily maintenance check of the exposure device and related radiographic equipment. This inspection will be conducted prior to the use ofthe equipment on each day that radiographic work is to be performed. Report defective equipment to the RSO immediately. Do not attempt to use defective equipment. After determining that the equipment is operative record the condition of the radiographic equipment.

1. Inspect the remote-control radiographic equipment as follows:

   a. Inspect the cables for cuts, breaks, and broken fittings.

   b. Inspect the crank for damage and loose hardware.

   c. Check operation of the control for freedom of drive cable movement.

   d. Inspect the guide tube for cuts, crimps, and broken fittings.

   e. Survey for radiation levels and record readings. The radiation levels should be about the same as those in previous daily inspections.

   f. Check that all safety **plugs are** in place.

   g. Inspect the exposure device for damage to fittings, lock, fasteners, and labels.

   h. Check for any impairment of the locking mechanism.

   i. Record the results of the daily inspection in the log.

2. Inspect a typical pipeliner device as follows:

   (Example given is for a pneumatically operated exposure device.)

A. Source Shield Assembly

Make a radiation survey of exterior surfaces of the source shield assembly. With the center of the survey meter 6 inches (15 cm) from the surface, the radiation levels should not exceed 0.25 milliroentgen per hour per curie. Example: 80 curies x 0.25 mR/hr/curie = 20 mR/hr.

Visually inspect for signs of damage. Check the fastenings on the actuator. Look for missing or loose fasteners. Check to ensure the safety wiring on the fasteners is intact. Check the nameplate bearing the radiation symbol for presence and legibility. Check that the lock is operable.

B. Control Assembly

Visually check- for damage. Test for leaks by turning the control valve of OFF. Pump a vacuum of approximately 15 inches and observe the gauge. The gauge should remain steady. A falling gauge indicates a leak. A leaking control assembly must be repaired.

C. System Check

Conduct the check in an area where the source may be exposed. Position the source shield assembly so that the beam is directed away from you and preferably into a shielding wall or floor. Place a survey meter turned ON adjacent to the projector so you can observe it.

Connect the tube to the source shield assembly.

Lock the projector.

Connect the tube to the control assembly.

Set the control valve to OFF.

Pump vacuum to approximately 15 inches.

Turn the control to ON. Observe your survey meter. The radiation level should not change. If the radiation level increases, the lock is faulty and must be repaired.

Observe the vacuum gauge. A falling gauge indicates a leak in the control hose or source actuator.

Turn the control to OFF.

Remove the hose from the source shield assembly.

IMPORTANT: Be sure the control valve is turned to OFF. Be sure the hose is removed from the source shield assembly before unlocking.

Unlock the projector.

Replace the hose in the source shield assembly.

Turn the pump control valve to ON. Observe your survey meter. The radiation level should increase. Turn the control valve to OFF. The radiation level should decrease to initial level.

Record the results of the daily inspection in the log.